Problem 2 Lloyd-Mirror and The Method of Images Reading: COA 1.4.1, 1.4.2

a) Use equation 1.19 to calculate the pressure from a 150Hz point source located 25m below the surface. Plot the magnitude of the pressure over the rectangular region r=10m to r=1000m, z=0m to z=500m. (See Matlab psuedo-code at the end of this document for help.) How many beams are there? How many would you expect to see, given Eq. 1.29 ? Make another plot with the same parameters, but this time plot transmission loss (Eq 1.15) instead of the magnitude of the pressure.

b) With the same frequency and source depth, plot the TL vs. range only (for a fixed receiver depth of 200m, range varying from 10m to 8km). For comparison, plot the TL due to spherical spreading in open space on the same plot. In other words, reproduce Fig 1.9 but with a slightly larger range. Does spherical spreading, or Lloyd-Mirror drop off faster (in the limit of a large range)? Why?

Problem 3: Plotting Reflection Coefficients
Problem 1.6 from COA.
Reading: COA 1.6 (especially 1.6.1)

Matlab pseudo-code

Below is an outline of a matlab program to do Problem 1 of this homework. It is written for human readability, not efficiency. Using this code, it may take up to a minute to run what is required for Problem 1 on a modern laptop. Note that in Matlab “log” is log base e. “log10” is log base 10 (which is what we use for transmission loss). Also note how to make the axis have a proper aspect ratio, which is required in order to count the beams of the Lloyd-Mirror effectively.

```
% Initialize some variables here
ranges = linspace(10,1000,200);
depths = linspace(0,500, 200);
p = NaN(numel(depths), numel(ranges));
% Initialize p so it doesn't need to be resized each iteration of the loop.
for ranges_iter = 1:numel(ranges)
    for depths_iter = 1:numel(depths)
            r = ranges(ranges_iter);
```

```
            z = depths(depths_iter);
            p(depths_iter, ranges_iter) = [insert expression here]
    end
end

figure
imagesc(ranges, depths, ((abs(p))))
xlabel('ranges');
ylabel('depths');
axis equal
axis tight

figure
imagesc(ranges, depths, -20*log10((abs(p))))
xlabel('ranges');
ylabel('depths');
axis equal
axis tight
```